What we claim is:

1. A crosslinkable aromatic resin having a protonic acid, which comprises that the crosslinkable aromatic resin contains a crosslinkable group, and that the crosslinkable group is not derived from the protonic acid group and can form a polymer network without forming any elimination component.

2. The crosslinkable aromatic resin having a protonic acid group according to claim 1, wherein the crosslinkable group comprises an alkyl group having 1 to 10 carbon atoms directly bonded to the aromatic ring and/or an alkylene group having 1 to 3 carbon atoms in the main chain in which at least one carbon atom directly bonded to the aromatic ring bonds to hydrogen, and a carbonyl group.

3. The crosslinkable aromatic resin having a protonic acid group according to claim 2, wherein the crosslinkable aromatic resin contains a crosslinkable group comprising an alkyl group having 1 to 10 carbon atoms directly bonded to the aromatic ring and/or an alkylene group having 1 to 3 carbon atoms in the main chain in which at least one carbon atom directly bonded to the aromatic ring bonds to hydrogen, and a carbonyl group, and a protonic acid group, and can be crosslinked by light, heat and/or electron rays.

4. The crosslinkable aromatic resin having a protonic acid group according to claim 2, wherein the crosslinkable aromatic resin having a protonic acid group is an aromatic resin having a carbonyl group, an alkyl group having 1 to 10 carbon atoms directly bonded to the aromatic ring and/or an alkylene group having 1

to 3 carbon atoms in the main chain in which at least one carbon atom directly bonded to the aromatic ring bonds to hydrogen, and a protonic acid group, and being selected from the group consisting of aromatic polyethers, aromatic polyamides, aromatic polyimides, aromatic polyamideimides and aromatic polyazoles.

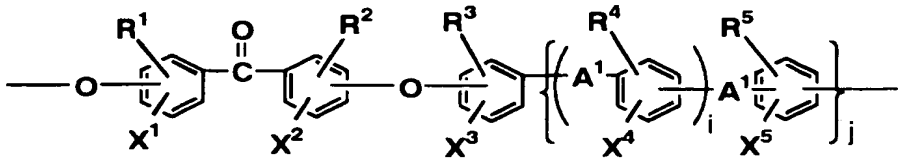
5. The crosslinkable aromatic resin having a protonic acid group according to claim 2, wherein the crosslinkable aromatic resin having a protonic acid group is a photo-crosslinkable polyether ketone containing a protonic acid group and an aromatic ring to which an alkyl group having 1 to 10 carbon atoms and/or an alkylene group having 1 to 3 carbon atoms in the main chain in which at least one carbon atom directly bonded to the aromatic ring bonds to hydrogen directly bonded.

6. The crosslinkable aromatic resin having a protonic acid group according to claim 2, wherein the crosslinkable aromatic resin having a protonic acid group is an aromatic polyetherketone comprising, based on the total repeating structural units,

10 to 100 % by mol of the repeating structural unit represented by the following formula (6) below, and

0 to 90 % by mol of the repeating structural unit represented by the following formula (7) below,

in which at least one of R^1 to R^{10} is $-C_mH_{2m+1}$ (wherein m is an integer of 1 to 10) and at least one of X^1 to X^{10} is a protonic acid group.



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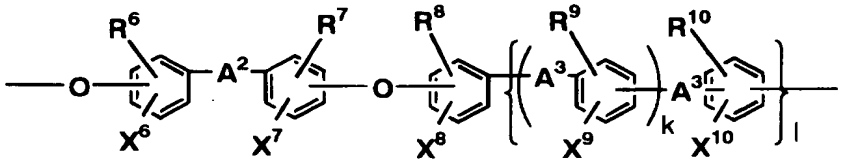


(7)

[in formulas (6) and (7), each of R^1 to R^{10} independently represents H or $-C_mH_{2m+1}$ (wherein m is an integer of 1 to 10), each of X^1 to X^{10} independently represents H or a protonic acid group; each of A^1 to A^3 independently represents a direct bond, $-CH_2-$, $-C(CH_3)_2-$, $-C(CF_3)_2-$, -O-, $-SO_2-$ or -CO-; each of i, j, k and l independently represents 0 or 1; and the hydrogen atom bonded to the aromatic rings in the formula (6) and (7) may be substituted with $-C_mH_{2m+1}$ (wherein m is an integer of 1 to 10), a protonic acid group, Cl, F or CF_3.]

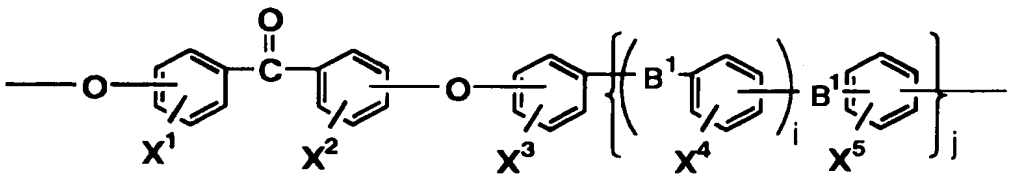
7. The crosslinkable aromatic resin having a protonic acid group according to claim 2, wherein the crosslinkable aromatic resin having a protonic acid group is an aromatic polyetherketone comprising, based on the total repeating structural units,

10 to 100 % by mol of the repeating structural unit represented by the following formula (6') below, and

0 to 90 % by mol of the repeating structural unit represented by the following formula (7') below,

in which at least one of B^1 to B^3 is a group represented

by the formula: $-CH(C_xH_{x+1})\{C(C_yH_{y+1})(C_{y'}H_{y'+1})\}_\alpha\{C(C_zH_{z+1})(C_{z'}H_{z'+1})\}_\beta-$, wherein x is an integer of 0 to 9, each of y, y', z and z' is independently an integer of 0 to 8, each of α and β is independently of 0 or 1 and $x+y+y'+z+z'+\alpha+\beta \leqq 9$, and at least one of X^1 to X^{10} is a protonic acid group.



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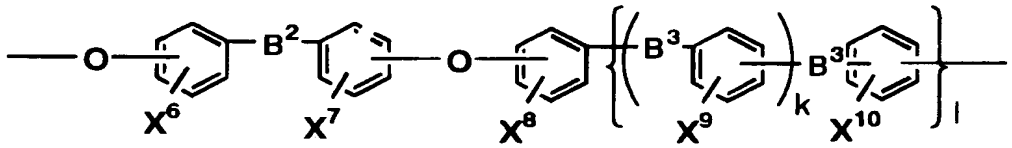


(7')

[in formulas (6') and (7'), each of X^1 to X^{10} independently represents H or a protonic acid group; each of B^1 to B^3 independently represents a direct bond, $-C(CF_3)_2-$, $-SO_2-$, -CO- or a group represented by the formula: $-CH(C_xH_{x+1})\{C(C_yH_{y+1})(C_{y'}H_{y'+1})\}_\alpha\{C(C_zH_{z+1})(C_{z'}H_{z'+1})\}_\beta-$, wherein x is an integer of 0 to 9, each of y, y', z and z' is independently an integer of 0 to 8, each of α and β is independently of 0 or 1 and $x+y+y'+z+z'+\alpha+\beta \leqq 9$; each of i, j, k and l independently represents 0 or 1; and the hydrogen atom bonded to the aromatic rings in the formula (6') and (7') may be substituted with $-C_mH_{2m+1}$ (wherein m is an integer of 1 to 10), a protonic acid group, Cl, F or CF_3.]

8. The crosslinkable aromatic resin having a protonic acid group according to claim 2, wherein the crosslinkable aromatic resin having a protonic acid group comprises a carbonyl group-containing resin having a carbonyl group, and a resin containing an alkyl group having 1 to 10 carbon atoms directly bonded to the aromatic ring or a resin containing an alkylene group having 1 to 3 carbon atoms in the main chain in which at least one carbon atom directly bonded to the aromatic ring bonds to hydrogen, and at least one of the carbonyl group-containing resin and the resin containing an alkyl group or an alkylene group has a protonic acid group.

9. The crosslinkable aromatic resin having a protonic acid group according to claim 8, wherein each of the carbonyl group-containing resin and the resin containing an alkyl group or an alkylene group independently is an aromatic resin selected from the group consisting of aromatic polyethers, aromatic polyamides, aromatic polyimides, aromatic polyamideimides and aromatic polyazoles.

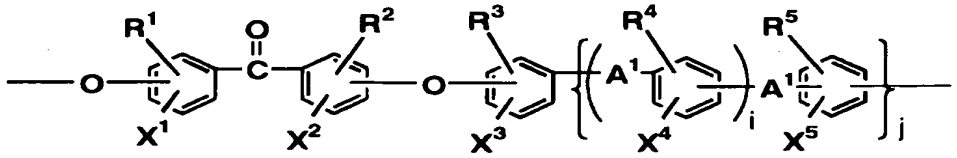
10. The crosslinkable aromatic resin having a protonic acid group according to claim 8, wherein the crosslinkable aromatic resin having a protonic acid group comprises, based on the total repeating structural units,

20 to 80 % by weight of the resin containing 10 to 100 % by mol of the repeating structural unit represented by the following formula (6), and,

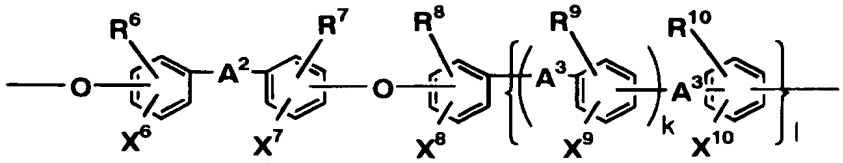
20 to 80 % by weight of the resin containing 10 to 100 % by mol of the repeating structural unit represented by the

following formula (7),

wherein at least one of R^6 to R^{10} is $-C_mH_{2m+1}$ (wherein m is an integer of 1 to 10) and at least one of X^1 to X^{10} is a protonic acid group.



(6)



(7)

[in formula (6) and (7), each of R^1 to R^{10} independently represents H or $-C_mH_{2m+1}$ (wherein m is an integer of 1 to 10), each of X^1 to X^{10} independently represents H or a protonic acid group; each of A^1 to A^3 independently represents a direct bond, $-CH_2-$, $-C(CH_3)_2-$, $-C(CF_3)_2-$, $-O-$, $-SO_2-$ or $-CO-$; each of i, j, k and l independently represents 0 or 1; and the hydrogen atom bonded to the aromatic rings in the formula (6) and (7) may be substituted with $-C_mH_{2m+1}$ (wherein m is an integer of 1 to 10), a protonic acid group, Cl, F or CF_3.]

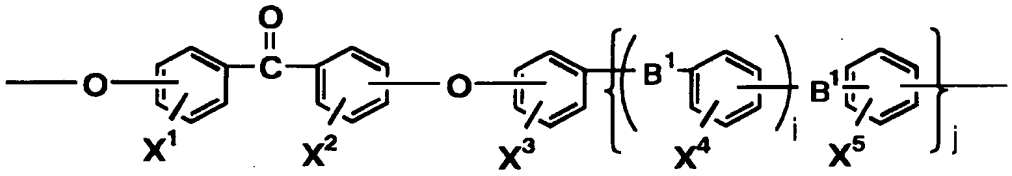
11. The crosslinkable aromatic resin having a protonic acid group according to claim 8, wherein the crosslinkable aromatic resin having a protonic acid group comprises, based on the total repeating structural units,

20 to 80 % by weight of the resin containing 10 to 100 % by mol of the repeating structural unit represented by the

following formula (6'), and,

20 to 80 % by weight of the resin containing 10 to 100 % by mol of the repeating structural unit represented by the following formula (7'),

wherein at least one of B^1 to B^3 is a group represented by the formula: $-CH(C_xH_{x+1})\{C(C_yH_{y+1})(C_{y'}H_{y'+1})\}_\alpha\{C(C_zH_{z+1})(C_{z'}H_{z'+1})\}_\beta-$, wherein x is an integer of 0 to 9, each of y, y', z and z' is independently an integer of 0 to 8, each of α and β is independently of 0 or 1 and $x+y+y'+z+z'+\alpha+\beta \leqq 9$, and at least one of X^1 to X^{10} is a protonic acid group.



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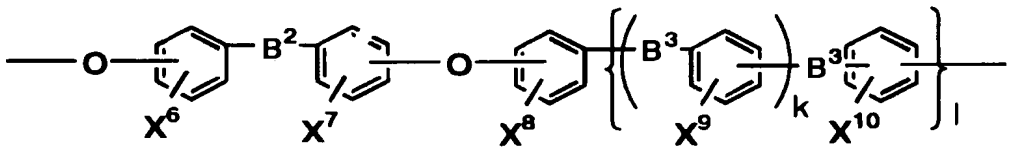


(7')

[in formula (6') and (7'), each of X^1 to X^{10} independently represents H or a protonic acid group; each of B^1 to B^3 independently represents a direct bond, $-C(CF_3)_2-$, $-SO_2-$, $-CO-$, or a group represented by the formula: $-CH(C_xH_{x+1})\{C(C_yH_{y+1})(C_{y'}H_{y'+1})\}_\alpha\{C(C_zH_{z+1})(C_{z'}H_{z'+1})\}_\beta-$, wherein x is an integer of 0 to 9, each of y, y', z and z' is independently an integer of 0 to 8, each of α and β is independently of 0 or 1 and $x+y+y'+z+z'+\alpha+\beta \leqq 9$; each of i, j, k and l independently

represents 0 or 1; and the hydrogen atom bonded to the aromatic rings in the formula (6') and (7') may be substituted with $-C_mH_{2m+1}$ (wherein m is an integer of 1 to 10), a protonic acid group, Cl, F or CF_3.]

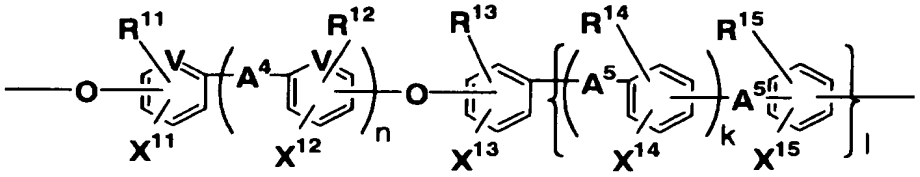
12. The crosslinkable aromatic resin having a protonic acid group according to claim 1, wherein the crosslinkable aromatic resin having a protonic acid group is an aromatic resin having a carbon-carbon double bond or a carbon-carbon triple bond, which is selected from the group consisting of aromatic polyethers, aromatic polyamides, aromatic polyimides, aromatic polyamideimides and aromatic polyazoles.

13. The crosslinkable aromatic resin having a protonic acid group according to claim 1, wherein the crosslinkable group is a carbon-carbon double bond or a carbon-carbon triple bond.

14. The crosslinkable aromatic resin having a protonic acid group according to claim 13, wherein the crosslinkable aromatic resin having a protonic acid group is an aromatic resin having a carbon-carbon double bond or a carbon-carbon triple bond, which is selected from the group consisting of aromatic polyethers, aromatic polyamides, aromatic polyimides, aromatic polyamideimides and aromatic polyazoles.

15. The crosslinkable aromatic resin having a protonic acid group according to claim 13, wherein the crosslinkable aromatic resin having a protonic acid group comprises an aromatic resin containing 20 to 100 % by mol, based on the total repeating structural units, of the repeating structural unit represented by the following formula (34), wherein at least one of R^{11} to R^{15}

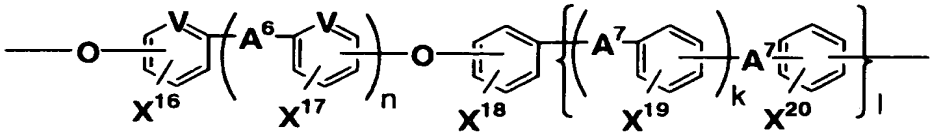
is $-C_mH_{2m}-CH=CH-R$ or $-C_mH_{2m}-C\equiv C-R$ (wherein m is an integer of 0 to 10, and R is H or phenyl) and at least one of X^{11} to X^{15} is a protonic acid group.



(34)

[wherein each of R^{11} to R^{15} independently represents H, $-C_mH_{2m}-CH=CH-R$ or $-C_mH_{2m}-C\equiv C-R$ (wherein m is an integer of 0 to 10, and R is H or phenyl); V independently represents CH, C-CN or N; each of X^{11} to X^{15} independently represents H or a protonic acid group; each of A^4 and A^5 independently represents a direct bond, $-CH_2-$, $-C(CH_3)_2-$, $-C(CF_3)_2-$, $-O-$, $-SO_2-$ or $-CO-$; each of k, l and n independently represents 0 or 1; the hydrogen atom bonded to the aromatic rings in formula (34) may be substituted with $-C_mH_{2m}-CH=CH-R$ or $-C_mH_{2m}-C\equiv C-R$ (wherein m is an integer of 0 to 10, and R is H or phenyl), a protonic acid group, Cl, F or CF_3].

16. The crosslinkable aromatic resin having a protonic acid group according to claim 13, wherein the crosslinkable aromatic resin having a protonic acid group comprises 20 to 100 % by mol, based on the total repeating structural units, of the repeating structural unit shown by the following formula (35), wherein at least one of X^{16} to X^{20} is a protonic acid group and the molecular end is $-R^a-CH=CH-R^b$ or $-R^a-C\equiv C-R^b$ (wherein R^a is phenylene and R^b is H or phenyl).



(35)

[wherein each of X^{16} to X^{20} independently represents H or a protonic acid group; V independently represents CH, C-CN or N; each of A^6 and A^7 independently represents a direct bond, $-CH_2-$, $-C(CH_3)_2-$, $-C(CF_3)_2-$, -O-, $-SO_2-$ or -CO-; each of k, l and n independently represents 0 or 1; the hydrogen atoms bonded to the aromatic rings in formula (35) may be substituted with a protonic acid group, Cl, F or CF_3].

17. The crosslinkable aromatic resin having a protonic acid group according to any one of claims 1 through 16, wherein the protonic acid group is $-C_nH_{2n}-SO_3Y$ (wherein n is an integer of 0 to 10; and Y is H, Na or K).

18. A crosslinked product, which is obtained by crosslinking the crosslinkable aromatic resin having a protonic acid group defined in any one of claims 1 through 16.

19. A polymer membrane, which is obtained using the crosslinkable aromatic resin having a protonic acid group defined in any one of claims 1 through 16.

20. An ion conductive polymer membrane for fuel cells, which is obtained by crosslinking the polymer membrane defined in claim 19.

21. The ion conductive polymer membrane for fuel cells according to claim 20, wherein the ion-exchange equivalent weight is not greater than 1000 g/mol and the methanol solubility is

less than 15% by weight.

22. An ion conductive binder for fuel cells, which contains the crosslinkable aromatic resin having a protonic acid group defined in any one of claims 1 through 16.

23. A composition for forming electrodes comprising the binder defined in claim 22 and electrode materials.

24. An electrode, which is obtained by using the binder defined in claim 22.

25. A fuel cell, which is obtained by using the polymer membrane defined in claim 19.

26. A fuel cell, which is obtained by using the binder defined in claim 22.

27. A fuel cell, which is obtained by using the electrode defined in claim 24.

28. A crosslinked product, which is obtained by crosslinking the crosslinkable aromatic resin having a protonic acid group defined in claim 17.

29. A polymer membrane, which is obtained using the crosslinkable aromatic resin having a protonic acid group defined in claim 17.

30. An ion conductive binder for fuel cells, which contains the crosslinkable aromatic resin having a protonic acid group defined in claims17.

31. An electrode, which is obtained by using the binder defined in claim 30.

32. A fuel cell, which is obtained by using the polymer membrane defined in claim 29.

33. A fuel cell, which is obtained by using the binder defined in claim 30.

34. A fuel cell, which is obtained by using the electrode defined in claim 31.